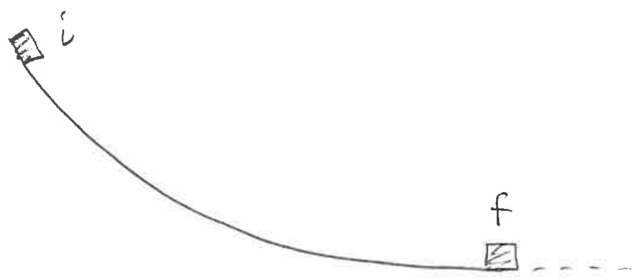


$V_i = 0$ $\qquad$ $y_f = 0$

energy conserved in each case:

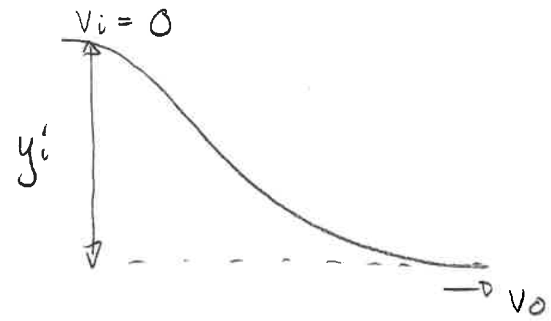
$$E_f = E_i$$

$$K_f + \cancel{U_{gf}} = \cancel{K_i} + U_{gi}$$

$$\Rightarrow \frac{1}{2}\cancel{m}v_f^2 = \cancel{m}gy_i \Rightarrow v_f = \sqrt{\frac{gy_i}{2}}$$

Mass is irrelevant - same. (i)

4ed Conc Q 3



$K_i + U_i = K_f + U_f$

$K_i = 0$

$U_f = 0$

$\Rightarrow \quad K_f = U_i$

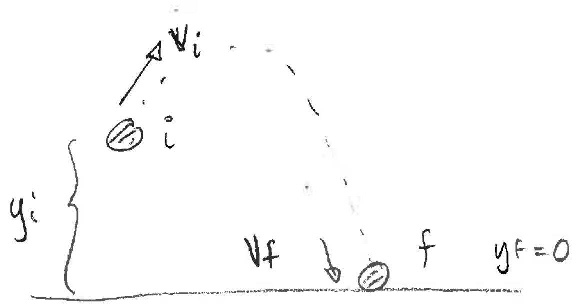
$\Rightarrow \quad \frac{1}{2}\cancel{m}v_0^2 = \cancel{m}g y_i$

$\Rightarrow \quad y_i = \frac{g}{2} v_0^2$

To get double v_0 need 4 times y_i

4ed Conc Q4

*

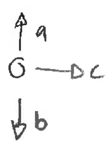


$K_i + U_i = K_f + U_f$

same   same   same   zero

Final kinetic energies are same

$\Rightarrow$ final speed same



4ed Knight Ch10

Conc Q 5

$U = \frac{1}{2} k (\Delta s)^2$

a) $U = \frac{1}{2} k d^2$

b) $U = \frac{1}{2} k d^2$

c) $U = \frac{1}{2} 2k d^2$

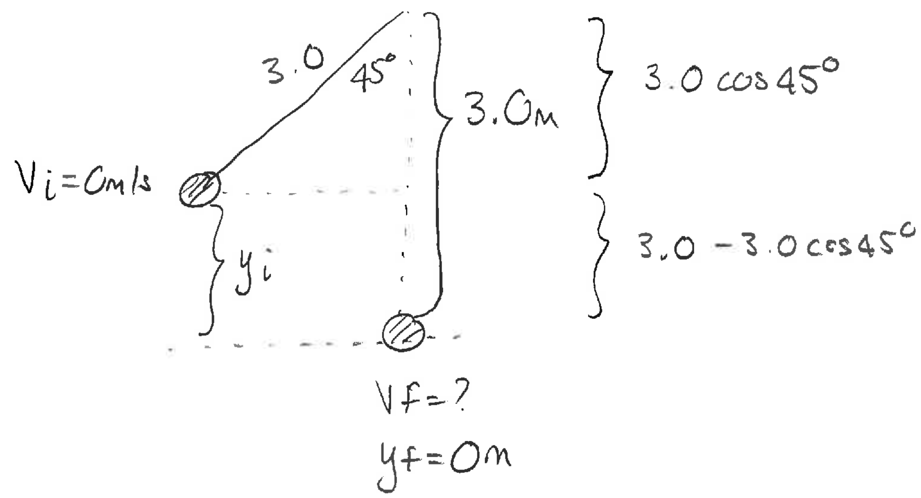
$= k d^2$

d) $U = \frac{1}{2} k (2d)^2 = 2 k d^2$

$d > c > a = b$.

Max speed is at lowest point.

At highest point, speed = 0 m/s



Energy conserved ⇒ $\cancel{K_i} + U_i = K_f + \cancel{U_f}$

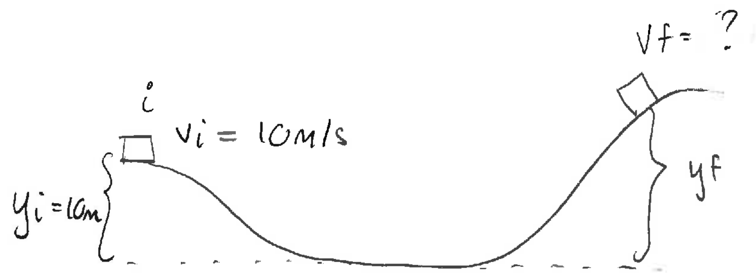
⇒ $\cancel{m} g y_i = \frac{1}{2} \cancel{m} V_f^2$ ⇒ $V_f = \sqrt{2 g y_i}$

Now $y_i = 3.0\text{m} - 3.0\text{m} \cos 45°$ from the geometry

$= 3.0\text{m}\left(1 - \frac{1}{\sqrt{2}}\right) = 3.0\text{m} \times \ldots = 0.88\text{m}$

⇒ $V_f = 4.1$ m/s

Get max height it could travel



$K_i + U_i = K_f + U_f$

$\frac{1}{2}\cancel{m}v_i^2 + \cancel{m}gy_i = \frac{1}{2}\cancel{m}v_f^2 + \cancel{m}gy_f$

$\Rightarrow \quad v_f^2 = v_i^2 + 2g(y_i - y_f)$

$= 100m^2/s^2 + 2 \times 9.8m/s^2(-5.0m)$

$= 2m^2/s^2$

$v_f = 1.4m/s$

Knight Ch 10

4ed Prob 20

initial

$V_i = ??$

$\Delta s_i = 0m$

final

$V_f = 0 m/s$

$\Delta s_f = 30m$

$$E_f = E_i$$

$$\Rightarrow \quad K_f + U_{spf} = K_i + U_{spi}$$

$$\Rightarrow \quad \cancel{\tfrac{1}{2} m v_f^2} + \tfrac{1}{2} k (\Delta s_f)^2 = \tfrac{1}{2} m v_i^2 + \cancel{\tfrac{1}{2} k (\Delta s_i)^2}$$

$$\Rightarrow \quad \frac{k}{m} (\Delta s_f)^2 = V_i^2$$

$$\Rightarrow \quad v_i = \sqrt{\frac{k}{m}}\, \Delta s_f$$

$$= \sqrt{\frac{60000\, N/m}{15000\, kg}}\; 30m$$

$$= \sqrt{4 s^{-2}}\; 30m = 60 m/s$$

$$\Rightarrow \quad V_i = 60 m/s$$

4ed Knight Ch10
Prob 43

~~Prob 47~~

b)

$y_i = 5.0m$ $\quad$ $y_f = 0m$

$V_i = 0m/s$ $\quad$ $V_f = ?$

$\Delta s_i = 2.0m$ $\quad$ $\Delta s_f = 0$

$$\cancel{K_i} + U_{spring\,i} + U_{grav\,i} = K_f + \cancel{U_{spring\,f}} + \cancel{U_{grav\,f}}$$

$$\frac{1}{2}k(\Delta s_i)^2 + mgy_i = \frac{1}{2}mv_f^2$$

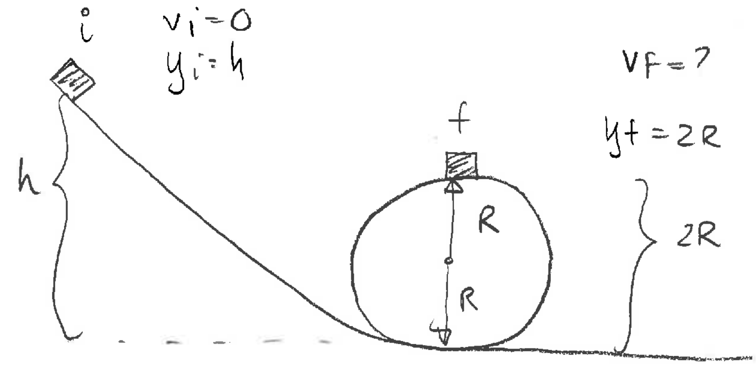
$$\Rightarrow \frac{k}{m}(\Delta s_i)^2 + 2gy_i = v_f^2$$

$$\Rightarrow V_f^2 = \frac{22\times10^3 N/m}{350kg} \times 4.0m^2 + 2\times9.8m/s^2\times5.0m$$

$$\Rightarrow V_f = 19m/s$$

4ed Knight Ch 10 *
Prob 45

Need speed of block at top of loop



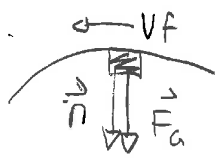
$$\cancel{K_i} + U_i = K_f + U_f$$
$$0$$

$$\cancel{m} g y_i = \frac{1}{2} \cancel{m} v_f^2 + \cancel{m} g y_f \Rightarrow v_f^2 = 2g(y_i - y_f)$$

$$v_f^2 = 2g(h - 2R)$$

$$\Rightarrow v_f = \sqrt{2g(h-2R)}$$

To move in a circle, we need normal force $\neq 0$.



$$\vec{F}_{net} = m\vec{a}$$

$$\Rightarrow n + mg = ma = \frac{m v_f^2}{R}$$

$$\Rightarrow n = m\left(\frac{v_f^2}{R} - g\right)$$

For normal force $= 0$ $\quad v_f^2 = Rg$

Thus we get

$$R\cancel{g} = 2\cancel{g}(h - 2R) \Rightarrow R = 2h - 4R$$

$\Rightarrow \quad h = \frac{5}{2}R$